Designation: D 6048 – 02

Standard Practice for Stress Relaxation Testing of Raw Rubber, Unvulcanized Rubber Compounds, and Thermoplastic Elastomers[1]

This standard is issued under the fixed designation D 6048; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

There are a number of techniques used to identify the processability of raw rubber, unvulcanized rubber compounds, and thermoplastic elastomers (rubber and rubberlike materials). Most measure a single averaged value of non-Newtonian viscosity with some doing so after a period of steady shear. These techniques may not provide sufficient information with regards to the processability of a selected material, as they: (*1*) fail to provide a measure of the viscoelastic behavior, and (*2*) destroy structure of the selected material through the steady shearing.

Stress relaxation testing provides a measure of the viscoelastic response of a material over a period of time without destroying the structure of the sample. In such testing both the instantaneous and time-dependent response to an applied deformation are measured. The information from this single experiment can then be used to examine a material's reaction to various different process conditions.

There are several different techniques for measuring stress relaxation properties of rubber and rubberlike materials. This practice serves to provide the reader with some background information about those techniques in terms of the theory of testing and the interpretation of results. Many concepts are put forward that are not discussed in depth, for to do so would require a textbook, not a practice. The reader is therefore encouraged to consult the identified references.

1. Scope

1.1 This practice covers several different techniques for determining the stress relaxation characteristics of rubber and rubberlike materials and for the possible interconversion of this stress relaxation information into dynamic mechanical properties.

1.2 The techniques are intended for materials having stress relaxation moduli in the range of 10^3 to 10^8 Pa (0.1 to 1.5×10^4 psi) and for test temperatures from 23 to 225°C (73 to 437°F). Not all measuring apparatus may be able to accommodate the entire ranges. These techniques are also intended for measurement of materials in their rubbery or molten states, or both.

1.3 Differences in results will be found among the techniques. Because of these differences, the test report needs to include the technique and the conditions of the test. This information will allow for resolving any issues pertaining to the test measurements.

1.4 The generalized descriptions of apparatus are based on the measurement of force as a function of time. Mathematical treatment of that relationship produces information that can be representative of material properties. Mathematical transformation of the force measurements will first yield stress relaxation moduli with subsequent transformation producing dynamic mechanical properties.

1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information only.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 1566 Terminology Relating to Rubber[2]

D 1646 Test Methods for Rubber—Viscosity, Stress Relaxation, and Pre-Vulcanization Characteristics (Mooney Viscometer)[2]

D 5992 Guide for Dynamic Testing of Vulcanized Rubber and Rubber-Like Materials Using Vibratory Methods[2]

[1] This practice is under the jurisdiction of Committee D11 on Rubber and is the direct responsibility of Subcommittee D11.12 on Processability Tests.

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[2] *Annual Book of ASTM Standards*, Vol 09.01.

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